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REMARKS

Claims 1-31 remain pending.

In the Office Action, the Examiner objected to the specification; rejected claims 1, 3, 5-8, 10, 11, 15, and 25 under 35 U.S.C. § 102(b) as being anticipated by Wang (U.S. Patent No. 6,118,656); rejected claims 19 and 22 under 35 U.S.C. § 102(b) as being anticipated by Nelson et al. (U.S. Patent No. 4,953,634); rejected claims 29 and 30 under 35 U.S.C. § 102(b) as being anticipated by Chrysler et al. (U.S. Patent No. 4,765,397); rejected claims 2, 4, 12, and 14 under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Tuckerman et al. (U.S. Patent No. 4,450,472); rejected claims 13 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Wang; rejected claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Ognibene et al. (U.S. Patent No. 6,273,186); rejected claims 16 and 17 under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Shibasaki et al. (U.S. Patent No. 6,223,815); rejected claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Shibasaki et al. and further in view of Suzaki (U.S. Patent No. 6,466,441); rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al.; rejected claim 21 under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Chrysler et al.; rejected claims 23 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Suzaki; rejected claim 27 under 35 U.S.C. § 103(a) as being unpatentable over Tuckerman et al. in view of Wang; rejected claim 28 under 35 U.S.C. § 103(a) as being unpatentable over Tuckerman et al. in view of Wang and further in view of Schmidt (U.S. Patent No. 3,658,584); and rejected claim 31 under 35 U.S.C. § 103(a) as being unpatentable over Chrysler et al. in view of Ognibene et al.

The objection to the specification has been obviated by the above amendment to paragraph [0027].

Claims 1-18, 25, and 26:

Applicants respectfully traverse the 35 U.S.C. § 102(b) rejection of claims 1, 3, 5-8, 10, 11, 15, and 25 over Wang. Claim 1, as amended, requires a device including, *inter alia*, “enclosed channels to carry a liquid coolant that are proximate to a surface of the integrated

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circuit chip and that extend along a length of the integrated circuit chip.” Claim 10, as amended, requires a device including, *inter alia*, “a heat exchange layer over the semiconductor base and including enclosed channels formed therein suitable for carrying liquid coolant.” Claim 25, as amended, requires a system including, *inter alia*, “a semiconductor device including enclosed arteries therein suitable for carrying liquid coolant through the semiconductor device, a density of the enclosed arteries across a first portion of the semiconductor device being greater than a density of the enclosed arteries across a second portion of the semiconductor device.” Wang fails to disclose all elements of the devices and system set forth in amended claims 1, 10, and 25.

The gaps among fins 146 that are cited on pages 2-4 of the Office Action do not reasonably disclose the claimed “enclosed channels” or “enclosed arteries,” because such gaps are open at the top. Nor does the “air flow” across a heat sink disclosed by Wang reasonably disclose the claimed “liquid coolant” set forth in claims 1, 10, and 25.

Because Wang fails to disclose all elements of claims 1, 10, and 25, as amended, a *prima facie* case of anticipation cannot be established, and the § 102(b) rejection over Wang should be withdrawn. Claims 3, 5-8, 11, and 15 are allowable at least by virtue of their dependence on claims 1 and 10.

Regarding claims 2, 4, 9, 12-14, 16-18, and 26, the proposed modification of Wang (claims 13 and 26), the addition of Tuckerman et al. (claims 2, 4, 12, and 14), the addition of Ognibene et al. (claim 9), , the addition of Shibasaki et al. (claims 16 and 17), or the addition of Suzaki (claim 18), even if such were proper, fail to cure the deficiencies of Wang noted above. To the extent that these references disclose either enclosed channels or liquid coolant, the pending rejections do not set forth why one of ordinary skill would have added such to the open-ended, air-cooled heat sink taught by Wang. In view of the above, a *prima facie* case of obviousness cannot be established for claims 2, 4, 9, 12-14, 16-18, and 26, and the § 103(a) rejections thereof should be withdrawn.

Claims 19-24:

Applicants respectfully traverse the 35 U.S.C. § 102(b) rejection of claims 19 and 22 over Nelson et al. Claim 19 requires a device including, *inter alia*, “an integrated circuit chip

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including channels in a surface thereof.” Nelson et al. fails to disclose all elements of the device set forth in claim 19.

Page 4 of the Office Action reads the claimed integrated circuit chip on chip 24, but reads the claimed channels on channels 34 of housing 20 in Nelson et al. Figs. 1A and 1B of Nelson et al., however, plainly show housing 20 (including base 22 and top 26) to be distinct and above chip 24. Hence, channels 34 are not reasonably “in a surface” of chip 24, as required by claim 19.

Because Nelson et al. fails to disclose all elements of claim 19, a *prima facie* case of anticipation has not been established, and the § 102(b) rejection should be withdrawn. Claim 22 is allowable at least by virtue of its dependence on claim 19.

Regarding claims 20, 21, 23, and 24, the proposed modification of Wang (claim 20), the addition of Chrysler et al. (claim 21), or the addition of Suzaki (claims 23 and 24), even if such were proper, fail to cure the deficiencies of Nelson et al. noted above. In particular, Chrysler et al. and Suzaki also fail to teach or suggest “an integrated circuit chip including channels in a surface thereof” as claimed, and the Office Action does not allege or prove such. In view of the above, a *prima facie* case of obviousness cannot be established for claims 20, 21, 23, and 24, and the § 103(a) rejections thereof should be withdrawn.

Claims 29-31:

Applicants respectfully traverse the 35 U.S.C. § 102(b) rejection of claims 29 and 30 over Chrysler et al. Claim 29 requires a device including, *inter alia*, “an integrated circuit chip; and channels to carry a coolant that are proximate to a surface of the integrated circuit chip and that extend along a length of the integrated circuit chip, wherein the channels are longitudinally offset at least once along the length of the integrated circuit chip.” Chrysler et al. fails to disclose all elements of the device set forth in claim 29.

Page 5 of the Office Action reads the claimed channels on Fig. 5 of Chrysler et al. Chrysler et al., however, only discloses that the fin assembly in Fig. 5 may be used with thermal conduction modules (TCMs). See in Fig. 1, TCMs 14 and fins 30 (an in particular col. 4, lines

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24-26). Further, Chrysler et al. discloses that these TCMs include a chip carrier on which “[a] hundred or so chips are mounted” (col. 1, lines 31-38).

Because Chrysler et al. only discloses that the TCMs are next to fins such as those shown in Fig. 5, and because Chrysler et al. does not disclose the internal structure of the TCMs, no actual evidence has been provided that Chrysler et al. only discloses “channels to carry a coolant that are proximate to a surface of the integrated circuit chip,” as required by claim 29. Nor is such proximity of the channels inherent. There may be, for example, enough material between the chips within the TCMs and the disclosed fins that these fins may not be reasonably considered to be “proximate to a surface of the integrated circuit chip,” as claimed.

Further, no evidence has been provided from Chrysler et al. that the fin breaks shown in Fig. 5 occur “at least once along the length of the integrated circuit chip.” As quoted earlier, each TCM includes a hundred or so chips, and there is no disclosure of the location of the fin breaks relative to any one of these. Nor is “at least once along the length of the integrated circuit chip” inherent in Chrysler et al., because it is entirely possible that the fin discontinuities shown in Fig. 5 occur at a location where no chips are present within the TCM.

Because Chrysler et al. fails to disclose all elements of claim 29, a *prima facie* case of anticipation has not been established, and the § 102(b) rejection should be withdrawn. Claim 30 is allowable at least by virtue of its dependence on claim 29.

Regarding the 35 U.S.C. § 103(a) rejection of dependent claim 31, the proposed addition of Ognibene et al., even if it were proper, fails to cure the deficiencies of Chrysler et al. with regard to claim 29, from which it depends. Hence, the combination of Chrysler et al. and Ognibene et al. fails to teach or suggest all elements of claim 31 as well.

Claims 27 and 28:

Applicants respectfully traverse the 35 U.S.C. § 103(a) rejection of claims 27 and 28 over Tuckerman et al. in view of Wang, with or without Schmidt. A *prima facie* case of obviousness has not been established, because no evidence has been provided that one of ordinary skill would have been motivated to add the teachings of Wang to Tuckerman et al. Only a bare conclusion of

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“to increase the heat dissipation” has been alleged, which is legally insufficient to establish a *prima facie* case. See M.P.E.P. § 2143.01.

Moreover, Wang’s exclusive teaching of open-ended channels with air cooling teaches away from the combination. See M.P.E.P. § 2145(X)(D) (“proposed modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference”). The proposed combination of liquid-cooled and air-cooled systems would change the intended purpose or principle of operation of Tuckerman et al., Wang, or both.

Because no motivation to combine the references has been shown, a *prima facie* case of obviousness has not been established for claims 27 and 28, and the rejection thereof should be withdrawn.

Reconsideration and allowance of claims 1-31 are respectfully requested.

In the event that any outstanding matters remain in this application, Applicants request that the Examiner contact Alan Pedersen-Giles, attorney for Applicants, at the number below to discuss such matters.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-0221 and please credit any excess fees to such deposit account.

Respectfully submitted,

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